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frond of the fern, and the leafy axis of the club moss." When revolutionary ideas are combined with evident lack of familiarity with the structures under discussion, it is no wonder that confusion is the result.—J. M. C.

**Development of heterotypic chromosomes.**—Two years ago MOTTIER published a preliminary account<sup>11</sup> of his views as to the development of the heterotypic chromosomes in pollen mother cells, and the full paper has just now appeared.<sup>12</sup> His paper consists of two parts: first, a statement of the results of his studies of five angiosperms (*Podophyllum peltatum*, *Lilium Martagon*, *L. candidum*, *Tradescantia virginica*, and *Gallonia candidans*); and second, a discussion of several cytological phenomena, reviewing the work of previous investigators and giving a purely theoretical account of the possible relationships of chromosomes to hereditary characters.

The few points which he has specially emphasized in his own studies on these five forms are as follows: (1) The resting nucleus of the pollen mother cell consists of a linin net, the ground matrix in which the chromatin is held. The chromatin is in the form of very fine granules of uniform size or in larger aggregations or clumps which are composed of smaller granules. (2) In synapsis he has not found a union of two spirems. (3) The loose or hollow spirem which has emerged from synapsis is of the double nature, which he believes to be due to a new longitudinal splitting that provides for the second division. (4) Segmentation of this loose or hollow spirem into chromosomes takes place during or following the second contraction stage. The second contraction consists in the arrangement of a large part of the spirem into loops that tend to radiate from a loosely entangled central mass of the thread. The loops are formed by the approximation of the parallel portions of longer turns of the spirem. Each loop represents a bivalent chromosome, each parallel part being a single chromosome. The two parallel parts or chromosomes are arranged tandem, or end to end in the spirem. (5) He seems to emphasize the point that the shortening and thickening of the spirem occurs, in the main, after segmentation of the spirem into chromosomes.

Taking his results as a whole, they confirm essentially the view already advanced by FARMER and MOORE, SCHAFFNER, and STRASBURGER. His theoretical discussion starts from this point: he has never found the number of chromosomes to be represented by prochromosomes in presynaptic stage; all identity of such bodies is lost. He thinks granules in the resting nucleus should be connected with smaller units, the pangens (following the terminology of DEVRIES); and with a purely theoretical consideration of the pangens and their relation to chromosomes and to heredity, the paper closes.—S. YAMANOUCHI.

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<sup>11</sup> MOTTIER, D. M., The development of the heterotypic chromosomes in pollen mother cells. *BOT. GAZETTE* 40:171-177. 1905.

<sup>12</sup> MOTTIER, D. M., The development of the heterotypic chromosomes in pollen mother cells. *Annals of Botany* 21:309-347. *pls.* 27, 28. 1907.